ACTA Geographica Szegediensis Tomus XXXVII. 2000. pp. 45-50.

CLASSIFICATION OF LANDFORMS CREATED BY QUARRY OPERATION

Karancsi, Zoltán

Introduction

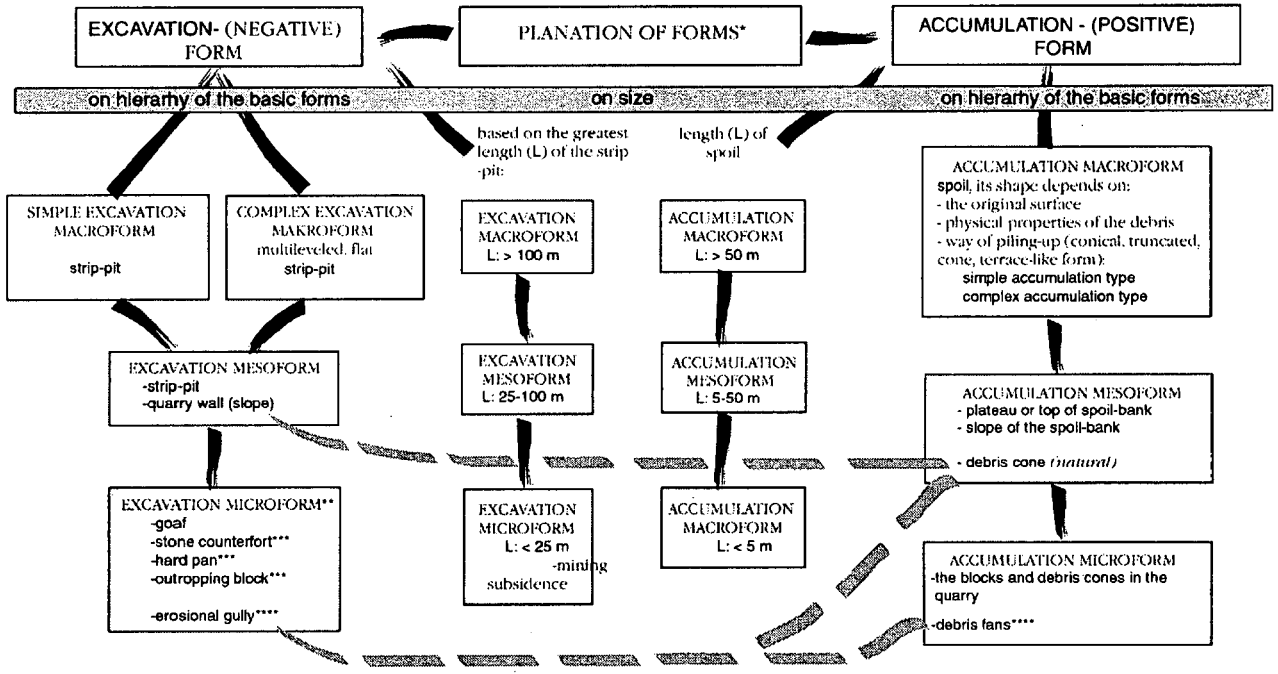
In the Hungarian geomorphological literature the study of anthropogenic influence on landscape was not of great importance until the middle of the 1950s. At that time this attitude changed and in a university textbook "few pages" were assigned to the problems of anthropogenic geomorphology (*Bulla B. 1954*). Since that time several scientists have dealt with the topic – Erdősi, F. (*1966, 1969, 1978, 1987*), Juhász, Á (*1974, 1975, 1976*), Pataki, J. (*1961*), Pécsi, M. (*1971*), Szabó, J. (*1993*), Kerényi, A. (*1995*) and Karancsi, Z.-Mucsi, L. (*1997*).

The quarry operations are the most intensive human interventions that considerably transform the natural environment. The establishment of quarries changes not only the natural vegetation, soils and fauna, but it also demolishes geological structures. Therefore, the circulation system of the groundwater changes as well, and the creation new strip pits and pi-heaps changes the morphology of the landscape too.

Typifying of montanogen forms

The first classification of positive and negative forms created by quarry operation (montanogenous landscape alteration) was created by Erdősi, F. (*1966, 1987*), then by Dávid, L. (*1998, 1999*). We have classified the montanogenous forms following the above two classifications and by complementing it on the basis of our experiments in our research area (the basalt quarries of the Medves Plateau) (*Karancsi, Z.-Dávid, L., 1999, Karancsi, Z. 2000).*

The results of the human intervention can be classified into two groups based on their characteristics compared to the original surface. Those forms which are formed by excavation belong to the first group (*excavational* or negative forms), and those which are created by accumulation are grouped to the second one (*accumulational* or positive forms). The strip pits and the mining subsidences are the excavational forms, while most of the positive forms are the results of piling-up of spoil. The material of the spoil is suitable for levelling the surface altered by quarrying and for filling up smaller abandoned strip-pits (aggradation). The levelling of positive and negative forms is called *planation* (*Szabó J. 1993*).



* the filling-up of negative forms (hollows) AGGRADATION
** based on their origin
*** they are considered as positive form comparing then the excavation macroform (i. e. wall)
**** they are formed by natural processes, as secondary forms

(edited by Z. Karancsi based on J. Szabó and L. Dávid 1999)

Figure 1 Typifying of montanogen forms

The strip mines can be classified on the basis of their area (length of mine) and the complexity of their forms: whether they are of strait or semicircular shape (simple excavational form), or they are multileveled flat mines, described by complex landform types (complex excavational type).

The **excavational forms** can be grouped further based on the *hierarchy or the size of their basic forms* (*Fig. 2*). In the first type of classification the quarries are regarded as excavational macroforms only if they influence the type and aesthetical appearance of the neighbouring landscape with their considerable size. The excavational mesoforms are those goafs < strips < troughs and walls which are within the strip-pits.[1] The stooks between stopes also belong to mesoforms. At the same time, the debris cones along the walls do not belong to the excavational mesoforms, because they were formed by accumulation, i.e., they are positive forms.

The outcropping blocks, stone counterforts, hard pans on the walls and other marks of certain processes (debris flow, land slide) can be considered as excavational microforms.[2] Although, if we compare their position to an excavational mesoform (i.e. wall) these can be even positive forms.

The excavational forms can be preciesely typified according to their *size* as it follows: Strip-pits (walls) with a maximum length more than 100 m are grouped to the excavational macroforms. The greatest length of the excavational mesoforms is between 25 and 100 m, while the microforms are shorter than 25 m.

Based on the *hierarchy of basic forms* the most common accumulation form is the spoil created by piling-up economicly worthless material. At the beginning of the quarry operation all materials covering the rocksurface (e.g. soil) are removed and piled-up as blind spoil. In the case of basalt quarrying all the debris produced during the stonework of ashlars will also increase the amount of spoil. The shape of the accumulation forms depends on the original surface, the way of piling-up and the physical properties of the debris. The development of the surface of these forms is influenced by several active physical and morphological agents, e.g. physical weathering caused by exogene and gravitational forces, chemical weathering, erosion by running water, deflation.

---

[1] A single strip-pit, a trough in a huge quarry, or even a wall can be excavational macroform.

[2] Those small pits grouped to this type, which are not wider nor deeper than 5,0-m.

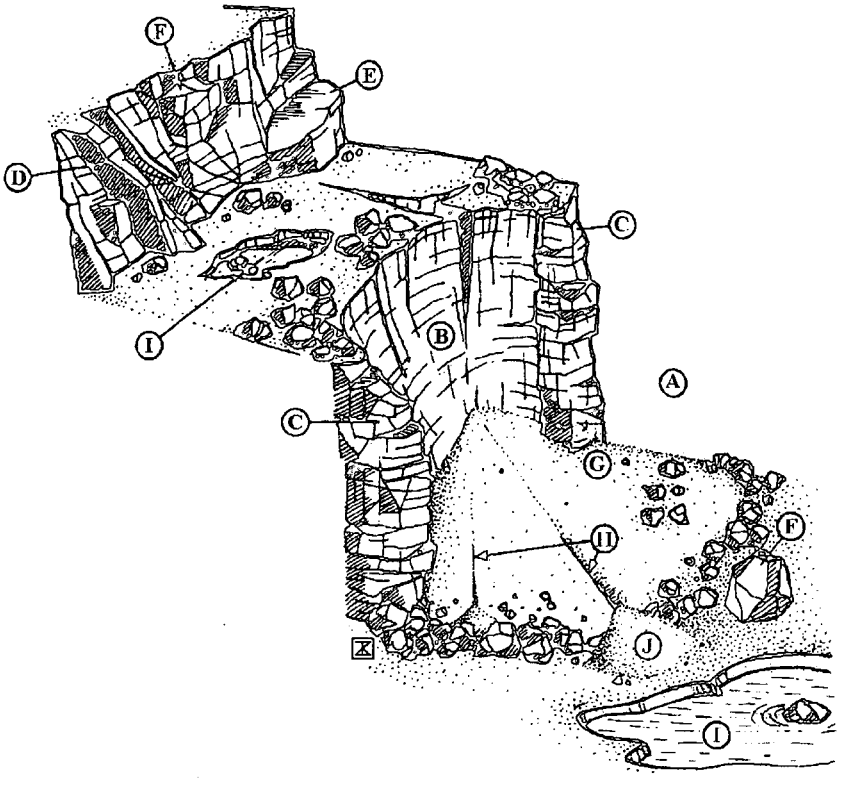


Figure 2 Forms of quarry
A: stip-pit, B: quarry wall, C: pillar, D: stone counterfort, E: hard pan,
F: outropping block, G: debris cone, H: erosion gullies, I: intermittent lakes,
J: secondary debris cone

The shape of spoil-banks depends on the original topography, on the physical and chemical properties of the debris and the way of accumulation (conical, truncated cone or terrace-like forms).

The basic forms of the spoil banks (*Fig. 3*) are plateaus –terrace like top of spoils – and slopes. Concerning the spoil piling techniques, the most characteristic parameter of the spoil will be its length, therefore, we have also typified the spoil-heaps based on their lenght. Spoil banks shorter than 5 m are microforms, while 5-50 m long ones are mesoforms, and those longer than 50 m are classified as macroforms.

On their surface - due to natural denudation – secondary forms will appear, such as debris cones at the ends of the erosional gullies. At the same time, the gully is a typical secondary negative form. Based on their most characteristic feature (height) the slopes of debris can be grouped by as micro-, meso- and macroforms together with their all secondary forms.

Conclusion

On our research area (Medves Region) all the quarries were closed in the middle of the 1980s, therefore, in the last twenty years mostly natural processes reshaped the quarries (illegal quarrying, removal of spoil, heaping waste material and building rubbish also changed their shape). The reclamation plans of the basalt quarries of the region were completed or were under construction by the end of 1998.

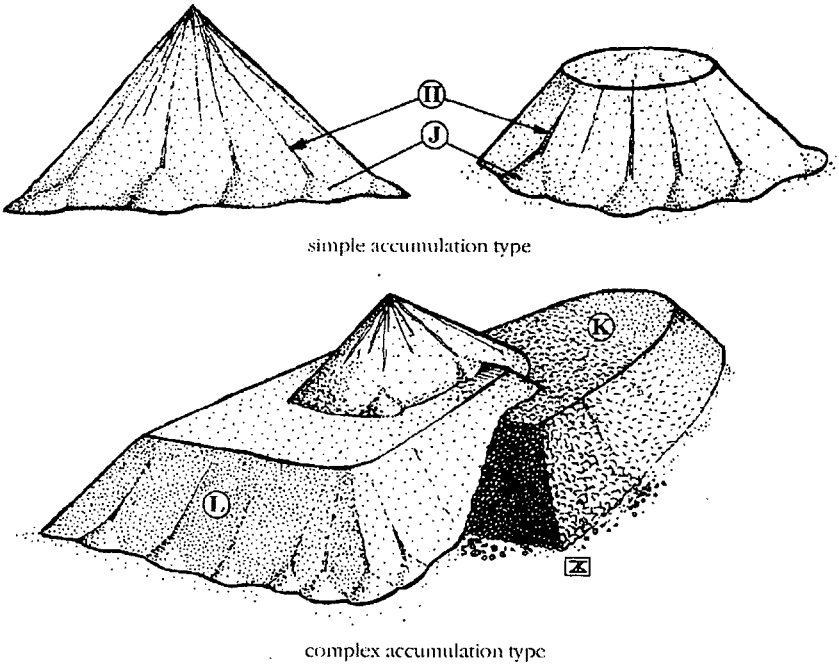


Figure 3 Form of spoil
H: erosion gullies, J: secondary debris cone, K: spoil's plateau, L: spoil's slope

The rehabilitation of the landscape can be carried out by creating terraces in a pleasing order, by planation, by escarping the walls so that the vegetation could occupy the area in a spontaneous way. The most important standpoint of reclamation must be safety. Therefore, after studying the stability of slopes and walls (by sounding) they must be stabilised. In the process of reclamation special attention should be paid for geological exposures revealed by quarry operation e.g. in the Eresztvény Quarry. These are often more spectacular than the natural exposures and they are excellent places for studying different rock beds, morphological forms and several geological processes. These places should not be covered but stops of tourist paths, natural trails should be established, therefore, they could play an important role in education.

References

Bulla, B. 1954. Általános természeti földrajz II. (Geomorfológia) – Tankönyvkiadó, Budapest, pp. 290-293.

Dávid, L. 1995. A kőbányászat felszínformáló szerepe a Mátra-hegység területén. – Acta Geographica Debrecina Tomus 33. pp. 145-168.

Dávid, L. 1996. A kőbányászati tevékenység felszínformáló szerepe és környezeti problémái. Geográfus doktoranduszok I. országos konferenciájának kiadványában. In: A társadalmi-gazdasági aktivitás területi-környezeti problémái (szerk: Tóth J., Wilhelm Z. 1996.) JPTE Pécs, pp. 13-24.

Erdősi, F. 1966. A bányászat felszínformáló jelentősége. – Földrajzi Közlemények, 14. 4. pp. 324-343.

Erdősi, F. 1969. Az antropogén geomorfológia mint új földrajzi tudományág. – Földrajzi Közlemények, pp. 11-25.

Erdősi, F. 1978. Történelmi források és térképek szerepe a környezetben antropogén hatásra végbement változások földrajzi vizsgálatakor. – Földrajzi Közlemények, 26. pp. 118-127.

Erdősi, F. 1987. A társadalom hatása a felszínre, a vizekre és az éghajlatra a Mecsek tágabb környezetében – Akadémiai Kiadó, Budapest, p. 228.

Juhász, Á. 1974. Antropogén hatások és geofolyamatok Komló környékén. – Földrajzi Értesítő, 23. pp. 223-226.

Juhász, Á. 1975. Az antropogén hatások felszínformáló szerepe és jelentősége a környezetvédelem szempontjából.–Földrajzi Közlemények. 1. pp. 14-17.

Juhász, Á. 1976. Antropogén hatások vizsgálata és térképezése ipari bányászati területeinken. – Földrajzi Értesítő, 25. pp. 249-253.

Karancsi, Z-Mucsi, L. 1997. Human impact on the Medves region, N-Hungary. Zeitschrift für Geomorphologie, VIII. pp. 247-253.

Karancsi, Z. 2000.A bányászat hatása a Medves-térség környezetváltozására. Geográfus doktoranduszok III. országos konferenciájának kiadványába leadva. Debrecen, (1998. Szeptember 3-4.)

Karancsi, Z.-Dávid, L. 1999. Analysis of anthropogenic effects of quarries in a hungarian basalt volcanic area. PhD Hallgatók II. Nemzetközi Konferencia (Miskolc, 1999. augusztus 9-15.) kiadványában.

Kerényi, A. 1995. Általános környezetvédelem. Mozaik Oktatási Stúdió, Szeged, p. 383.

Pataki, J. 1961. Az antropogén morfológia és a gyakorlati élet. – Földrajzi Közlemények, 4. pp. 301-305.

Pécsi, M. 1991. A domborzati egyensúly megváltozása az ember műszaki-gazdasági tevékenysége következtében. In: Geomorfológia és domborzatminősítés, FKI, Budapest, pp. 175-183.

Szabó, J. 1993. A társadalom hatása a földfelszínre (antropogén geomorfológia). In: Borsy Z. (szerk.): Általános természeti földrajz. – Nemzeti Tankönyvkiadó, Budapest, pp. 500-518.

Karancsi, Zoltán

Juhász Gyula Teacher Training College Division, Department of Geography, University of Szeged, Hattyas sor 10., H-6725 Szeged, *karancsi@jgytf.u-szeged.hu*